is not operating properly, then the muscle stimulator **100** is automatically shut-off. In that manner, the patient receives a constant and accurate display of information concerning the operation of the muscle stimulator **100**. When the muscle stimulator **100** is first turned on using the switch **102**, the LCD **114** displays the default settings for each of the contract time, relax time, mode and treatment time. If those are the prescription settings for the particular patient using that muscle stimulator **100**, then there is no need to change the settings. Otherwise, the settings are changed as described previously.

As will be obvious to those of ordinary skill in the art, the data card **200** and its electrical and mechanical structure are such that it can readily be adopted for use in many types of devices, including, for example, any Class II type of device which is designed for unsupervised patient use. Likewise, such a data card could be used in various other types of devices, whether for a supervised patient use or otherwise.

Although only a preferred embodiment is specifically illustrated and described herein, it will be appreciated that many modifications and variations of the present invention are possible in light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

We claim:

1. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

a plurality of independently driven channels connected respectively to a like plurality of electrodes for independently treating a like plurality of separate muscle groups of a patient, each of said plurality of independently driven channels including its own drive circuit;

a digital data processor connected to each of said drive circuits for each providing a drive control signal for causing each of said drive circuits to generate said plurality of muscle stimulating signals;

each of said drive control signals causing its respective drive circuit to generate a muscle stimulating signal as a series of on and off pulses over a given time period; and

said pulses having a predetermined constant voltage and an intensity and a waveform shape such that the beginning of said pulse has a ramp portion from zero to maximum intensity, a middle portion constant at maximum intensity, and an end ramp portion from maximum intensity to zero,

such that there is a smooth transition from no pulses to the maximum pulse intensity and then back to no pulses in order to provide smooth muscle contractions and release of contractions.

2. The portable muscle stimulator of claim 1, wherein said maximum pulse intensity is selectable by said patient.

3. The portable muscle stimulator of claim 2, wherein said patient selects pulse intensity by increasing or decreasing charge per pulse.

4. The portable muscle stimulator of claim 1, wherein each of said pulses has a constant voltage level at said maximum intensity portion of said pulses.

5. The portable muscle stimulator of claim 1, wherein the time periods during which pulses are generated and not generated are selectable by said patient.

6. The portable muscle stimulator of claim 1, wherein pulse intensity for each of said plurality of independently driven channels is separately selectable by said patient.

7. The portable muscle stimulator of claim 1, wherein each of said plurality of independently driven channels

further includes a load detect circuit connected between each respective electrode and each respective drive circuit, for providing a feedback signal to said digital data processor indicative of an actual load experienced by each respective one of said plurality of drive circuits.

8. The portable muscle stimulator of claim 7, wherein said digital data processor receives said feedback signals from each load detect circuit and detects whether short or open circuit conditions exist in each of said plurality of independently driven channels.

9. The portable muscle stimulator of claim 8, wherein said digital data processor stops the generation of muscle stimulating signals in any of said independently driven channels in which at least one of an open and short circuit condition is detected.

10. The portable muscle stimulator of claim 1, wherein both of said ramp portions of said waveform shape are symmetrical with each other.

11. The portable muscle stimulator of claim 1, wherein each of said plurality of independently driven channels is synchronously driven.

12. The portable muscle stimulator of claim 1, wherein the maximum intensity of said pulses in each of said independently driven channels is independently controllable by said patient.

13. The portable muscle stimulator of claim 1, wherein each pair of said plurality of independently driven channels is synchronously driven within each pair and asynchronously driven with respect to each other pair of driven channels.

14. The portable muscle stimulator of claim 1, wherein an average value of the intensity of each of said pulses in each independently driven channel is calculated and stored for later review.

15. The portable muscle stimulator of claim 14, wherein said average values are stored in removable data storage which can be removed from said portable muscle stimulator without disabling said stimulator and sent to a remote location for review for compliance with a predetermined treatment plan for said patient.

16. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

a microcontroller;

a plurality of switches, each connected to be operated by said microcontroller;

a like plurality of output transformers, connected such that power stored in said portable muscle stimulator can be applied to said output transformers by said plurality of switches;

said microcontroller generating a series of pulse trains for generating output pulses by said plurality of output transformers for a first time period predetermined by a contract period selected by said patient and then no pulses for a second time period predetermined by a relaxation period selected by said patient, said output pulses having a predetermined constant voltage; and

wherein said microcontroller ramps up the intensity of each pulse at the beginning of each pulse train to an intensity preselected by said patient and then ramps down said intensity to zero at the end of said pulse train in order to allow a smooth transition from zero to maximum intensity to zero intensity, thereby achieving a smooth contraction and release of said patient's muscles.

17. The portable muscle stimulator of claim 16, wherein said ramping is controlled by said microcontroller and is

accomplished by incrementally increasing or decreasing pulse widths until a desired pulse width is achieved.

18. The portable muscle stimulator of claim 16, wherein each of said pulses has a constant voltage level at said maximum intensity portion of said pulses.

19. The portable muscle stimulator of claim 16, wherein said patient selects pulse intensity by increasing or decreasing charge per pulse.

20. The portable muscle stimulator of claim 16, wherein both said ramp up and said ramp down of said intensity produce symmetrical ramp waveforms.

21. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

at least three independently driven channels connected respectively to a like plurality of electrodes for independently treating a like plurality of separate muscle groups of a patient, each of said plurality of independently driven channels including its own drive circuit;

a digital data processor connected to each of said drive circuits for each providing a drive control signal for causing each of said drive circuits to generate said plurality of muscle stimulating signals;

each of said drive control signals causing its respective drive circuit to generate a muscle stimulating signal as a series of on and off pulses over a given time period; and

said pulses having an intensity and a waveform shape such that the beginning of said pulse has a ramp portion from zero to maximum intensity, a middle portion constant at maximum intensity, and an end ramp portion from maximum intensity to zero,

such that there is a smooth transition from no pulses to the maximum pulse intensity and then back to no pulses in order to provide smooth muscle contractions and release of contractions.

22. The portable muscle stimulator of claim 21, wherein said maximum pulse intensity is selectable by said patient.

23. The portable muscle stimulator of claim 22, wherein said patient selects pulse intensity by increasing or decreasing charge per pulse.

24. The portable muscle stimulator of claim 21, wherein each of said pulses has a constant voltage level at said maximum intensity portion of said pulses.

25. The portable muscle stimulator of claim 21, wherein the time periods during which pulses are generated and not generated are selectable by said patient.

26. The portable muscle stimulator of claim 21, wherein pulse intensity for each of said at least three independently driven channels is separately selectable by said patient.

27. The portable muscle stimulator of claim 21, wherein each of said at least three independently driven channels further includes a load detect circuit connected between each respective electrode and each respective drive circuit, for providing a feedback signal to said digital data processor indicative of an actual load experienced by each respective one of said plurality of drive circuits.

28. The portable muscle stimulator of claim 27, wherein said digital data processor receives said feedback signals from each load detect circuit and detects whether short or open circuit conditions exist in each of said at least three independently driven channels.

29. The portable muscle stimulator of claim 28, wherein said digital data processor stops the generation of muscle stimulating signals in any of said independently driven channels in which at least one of an open and short circuit condition is detected.

30. The portable muscle stimulator of claim 21, wherein both of said ramp portions of said waveform shape are symmetrical with each other.

31. The portable muscle stimulator of claim 21, wherein each of said at least three independently driven channels is synchronously driven.

32. The portable muscle stimulator of claim 21, wherein the maximum intensity of said pulses in each of said independently driven channels is independently controllable by said patient.

33. The portable muscle stimulator of claim 21, having four independently driven channels operated in pairs, wherein each of said independently driven channels is synchronously driven within each pair and asynchronously driven with respect to the other pair of driven channels.

34. The portable muscle stimulator of claim 21, wherein an average value of the intensity of each of said pulses in each independently driven channel is calculated and stored for later review.

35. The portable muscle stimulator of claim 34, wherein said average values are stored in removable data storage which can be removed from said portable muscle stimulator without disabling said stimulator and sent to a remote location for review for compliance with a predetermined treatment plan for said patient.

36. The portable muscle stimulator of claim 21, wherein said pulses have apredetermined constant voltage.

37. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

a plurality of independently driven channels connected respectively to a like plurality of electrodes for independently treating a like plurality of separate muscle groups of a patient, each of said plurality of independently driven channels including its own drive circuit;

a digital data processor connected to each of said drive circuits for each providing a drive control signal for causing each of said drive circuits to generate said plurality of muscle stimulating signals;

each of said drive control signals causing its respective drive circuit to generate a muscle stimulating signal as a series of on and off pulses over a given time period; and

said pulses having an intensity controlled by increasing or decreasing charge per pulse and a waveform shape such that the beginning of said pulse has a ramp portion from zero to maximum intensity, a middle portion constant at maximum intensity, and an end ramp portion from maximum intensity to zero,

such that there is a smooth transition from no pulses to the maximum pulse intensity and then back to no pulses in order to provide smooth muscle contractions and release of contractions.

38. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

a plurality of independently driven channels connected respectively to a like plurality of electrodes for independently treating a like plurality of separate muscle groups of a patient, each of said plurality of independently driven channels including its own drive circuit;

a digital data processor connected to each of said drive circuits for each providing a drive control signal for causing each of said drive circuits to generate said plurality of muscle stimulating signals;

each of said plurality of independently driven channels further including a load detect circuit connected between each respective electrode and each respective drive circuit, for providing a feedback signal to said digital data processor indicative of an actual load experienced by each respective one of said plurality of drive circuits;

each of said drive control signals causing its respective drive circuit to generate a muscle stimulating signal as a series of on and off pulses over a given time period; and

said pulses having an intensity and a waveform shape such that the beginning of said pulse has a ramp portion from zero to maximum intensity, a middle portion constant at maximum intensity, and an end ramp portion from maximum intensity to zero,

such that there is a smooth transition from no pulses to the maximum pulse intensity and then back to no pulses in order to provide smooth muscle contractions and release of contractions.

39. The portable muscle stimulator of claim 38, wherein said digital data processor receives said feedback signals from each load detect circuit and detects whether short or open circuit conditions exist in each of said plurality of independently driven channels.

40. The portable muscle stimulator of claim 39, wherein said digital data processor stops the generation of muscle stimulating signals in any of said independently driven channels in which at least one of an open and short circuit condition is detected.

41. A portable muscle stimulator for generating a plurality of muscle stimulating signals for application to a patient using a plurality of electrodes, comprising:

a plurality of independently driven channels connected respectively to a like plurality of electrodes for independently treating a like plurality of separate muscle groups of a patient, each of said plurality of independently driven channels including its own drive circuit;

a digital data processor connected to each of said drive circuits for each providing a drive control signal for causing each of said drive circuits to generate said plurality of muscle stimulating signals;

said digital data processor calculating and storing for later review an average value of the intensity of each of said pulses in each independently driven channel;

each of said drive control signals causing its respective drive circuit to generate a muscle stimulating signal as a series of on and off pulses over a given time period; and

said pulses having an intensity and a waveform shape such that the beginning of said pulse has a ramp portion from zero to maximum intensity, a middle portion constant at maximum intensity, and an end ramp portion from maximum intensity to zero,

such that there is a smooth transition from no pulses to the maximum pulse intensity and then back to no pulses in order to provide smooth muscle contractions and release of contractions.

42. The portable muscle stimulator of claim 41, wherein said average values are stored in removable data storage which can be removed from said portable muscle stimulator without disabling said stimulator and sent to a remote location for review for compliance with a predetermined treatment plan for said patient.]

43. A device for use by a patient in an unsupervised manner, the device comprising:

a removable data storage for storing data relating to at least one of usage and operation of a Class II device by the patient; and

a header for communicating with the removable data storage to retrieve the data relating to said at least one of the usage and the operation of the Class II device.

44. The device of claim 45, wherein said removable data storage comprises a card including storage media.

45. The device of claim 44, wherein the stored data can be extracted for review.

46. The device of claim 44, wherein:

the card comprises contacts; and

the header comprises female contacts for making electrical contact with the contacts of the card to retrieve the data.

47. The device of claim 44, wherein the storage media comprise an integrated circuit for storing the data.

48. The device of claim 47, wherein the integrated circuit is an EEPROM.

49. The device of claim 43, wherein the data comprise data for 30-60 days of use of the Class II device by the patient.

50. The device of claim 43, wherein the data comprise at least one date and time of usage of the Class II device.

51. The device of claim 43, wherein the data comprise a serial number of the Class II device.

52. The device of claim 43, wherein the data comprise a length of time in which the patient used the Class II device.

53. The device of claim 43, wherein the data comprise an average intensity of treatment by the Class II device.

54. The device of claim 43, wherein the data comprise a peak intensity of treatment by the Class II device.

55. The device of claim 43, wherein the data comprise data for each of a plurality of independently driven channels of the Class II device.

56. The device of claim 55, wherein the data for each fo the plurality of independently driven channels comprise an average pulse intensity in each of the plurality of independently driven channels.